

Any one of these might well call for detailed remark if space permitted. They show the author at his best, finely observant of overlooked points, subtly ingenious in devising new, quaint, and even startling possibilities. But the reader must be referred to the volume itself for a fuller appreciation of these qualities.

When one has gained much pleasure and profit from a work, it seems almost shabby to begin to find fault. Yet no critical reader of Dr. Venn's treatise can fail to perceive its defects. It is as if the author had boldly set them before our very eyes challenging criticism. The want of close connection has already been touched on. There seems, indeed, a surprising lack of systematic arrangement, as if the author had sat down to write without a clear plan before him. Poor formal logic gets badly treated. Thus we have an account of terms, propositions, including hypotheticals and disjunctives, but no account of the syllogism. Nor can it be said that the writer has introduced just as much of the common syllogistic logic as is needed for setting forth the processes of induction. Much given us under terms and propositions cannot well be regarded as needed in a treatise on the logic of induction. Sometimes, indeed, the author wanders into the mystic region of symbolic logic. Again and again he opens up in a tantalizing way views which he does not stop to establish. One may instance the point touched on (p. 43), whether the converse of a particular proposition is in substance a new proposition. This depends on our view of the import of a proposition, which, as already pointed out, is not adequately dealt with. Again, the author seems to deny the existence of a negative disjunctive of the type "Either A is not B or C is not D," but he does not trouble to prove the point, or indeed to make clear what he precisely means. It is surprising, again, to find Dr. Venn discussing the functions of the syllogism not only without giving any preliminary sketch of it, but without the barest reference to the nature of the axiom which underlies it. On the other hand, a good deal that is known to the general student from previous works (including the author's own) is needlessly repeated, and helps sadly to swell the size of the volume. Another feature that will strike every careful reader, and which is strongly suggestive of defective plan, is the frequency of the forward reference, as "we shall see by and by," and so forth. This is apt to be very confusing. In noting this, together with the comparative infrequency of the backward reference, one cannot help thinking of the author's remark on the popular view of causation, that it looks forward rather than backward.

A number of the author's statements seem to the present writer open to dispute. It must be surely a slip which makes him write of the classifications of natural history as made up of *collective* terms (p. 170). The Dicotyledons are surely not a collection in the sense in which the House of Commons is a collection. The limitation of the denotation of terms to present existences (p. 179) strikes one not only as highly capricious, but as inconsistent with what is said about differences of time in connection with predication. Once more, one would like to challenge the strong statement that the only easily discoverable instance of a purely verbal dispute is that about the "sameness" of a thing (p. 296). In one place, at least, the writer's ingenuity seems to carry him too far.

Writing of logical definition by genus and differentia (p. 302, by a slip written genus and species), Dr. Venn tries to show that this is perfectly rational on the supposition (which logic is bound to make) that we all know the meaning of our terms, or, since the very need of defining a term shows that there is one term of which this cannot be supposed, of all terms but one. But it is obvious that this consideration would equally suggest or justify an inverse process of definition, viz. by naming a lower species, and subducting its differentia. Such slight blemishes as these are probably inseparable from Dr. Venn's manner of work, and it can safely be said that they detract but little from the general and lasting impression of masterful competence which his volume is certain to leave on the student's mind.

JAMES SULLY.

REMSEN'S "INORGANIC CHEMISTRY."

Inorganic Chemistry. By Ira Remsen, Professor of Chemistry in the Johns Hopkins University. (London: Macmillan and Co., 1889.)

THIS book is of interest from the circumstance that it is the first of its kind in the language of any pretensions which is based upon the periodic law. It is further characterized by the fulness with which general relations are discussed. The attempt is made to present the facts of inorganic chemistry in such a manner as to bring out their analogies and connections, with a view of elucidating the broad general principles of the science. Details of experiments, either as showing the origin and modes of preparation of products, or as illustrating their leading properties, are for the most part omitted, or are relegated to an appendix containing special directions for laboratory work. The book is put together in a plain, straightforward manner, with no attempt at any literary airs and graces; indeed, we may add that at times the style verges on a simplicity which is perilously near being puerile. Having said this much in commendation of the general plan of the work, we have said all we can say in its praise. For, however excellent may be the plan of a treatise of chemistry, its main value, after all, must depend upon the accuracy and completeness of its statements; and, as we proceed to show, there is much in this book which is both inaccurate and incomplete. From the style in which it is issued, and its price, we presume that the work is intended for the benefit of comparatively advanced students—at all events for a higher grade than that for which the author's well-known smaller books were prepared. Indeed, we are distinctly informed that the earlier works were intended to form a series of which the present volume is the most advanced member. Now, whilst it may be convenient for the purpose of elementary teaching not to tell the whole of what is known about a thing, the advanced student, if he has any scientific instinct at all, insists on knowing the truth, the whole truth, and nothing but the truth. Unfortunately, he does not always get that from this work. Prof. Remsen is admirable in his introductory books. In these there is a reticence of statement and a subordination of facts which make the books excellent for the purposes of school-teaching. But in the larger book it appears to us that the author suffers from the defects of his excellencies: what is a merit in

the "Briefer Courses" becomes a positive blemish in the advanced work. Indeed, the volume before us seems to be nothing but the smaller work on inorganic chemistry "writ large," since in point of knowledge the student is not carried very much further than he is in that book. Take, for example, the statement respecting the mode of preparing hydrogen, given on pp. 26 and 27. We read that, when sulphuric acid acts upon zinc, the chemical change is represented both qualitatively and quantitatively by the equation $\text{Zn} + \text{H}_2\text{SO}_4 = \text{ZnSO}_4 + 2\text{H}$. This is stated without a word of qualification, in a long paragraph on the complex nature of the changes which take place in a chemical reaction; and yet every teacher knows that this equation does not express the truth, the whole truth, and nothing but the truth about the matter. Again, too, on p. 30, in the account of the mode of preparing oxygen, we have the conventional methods of representing the decomposition of potassium chlorate into equal parts of perchlorate and chloride, and the subsequent decomposition of the perchlorate into chloride, whereas Teed, and, subsequently, Frankland and Dingwall, showed some years ago that these equations altogether fail to represent what actually occurs.

McLeod's work on the part played by the admixed manganese dioxide in facilitating the evolution of oxygen from potassium chlorate is perhaps too recent to have received notice in the very meagre account given of the supposed modes of action of this substance; but the space occupied by the description of "gnomium," which is still more recent, might, we think, have been more profitably employed by some mention of Mercer's theory of "catalysis." This poverty of statement is, at times, almost exasperating. The account of Lavoisier's work, on p. 5, would have seriously jeopardized the chances of a London University matriculant if given in an examination paper. Nine out of ten average students would gather from this account that Lavoisier made chemistry what it is to-day by proving why it was that, "whenever water is boiled for a time in a glass vessel, a deposit of earthy matter is formed." With respect to the etymology of the term oxygen, it is stated that "the name is at present somewhat misleading," which might imply that it may possibly become less so in the future. On p. 298 we are told that "it was in an examination of urine for the purpose of discovering the philosopher's stone that phosphorus was first discovered in 1669." On p. 383 it is stated that "the name soda-water had its origin in the fact that the carbon dioxide used in charging the water is frequently made from primary or acid sodium carbonate." Are we to infer also that lithia and potash waters are prepared from carbonic acid evolved from the carbonate of the respective metals? On p. 141 we read that Lavoisier "considered chlorine to be an oxygen compound of some undiscovered element which was called *murium*. . . . The acid was accordingly called *muriotic acid*. . . ." If this implies that the term "muriotic acid" was derived from *murium*, it is contrary to Lavoisier's own account of the origin of the name. On pp. 60 and 61 of his "Traité Élémentaire de Chimie," partie I, chap. iii. ("Œuvres de Lavoisier," Imprimerie Impériale), "De la Nomenclature des Acides en général, et particulièrement de ceux tirés du salpêtre et du sel marin," he says:—

"Rien ne nous a été plus facile que de corriger et de modifier l'ancien langage à l'égard de ces acides; nous avons converti le nom d'acide vitriolique en celui d'acide sulphurique, et celui d'air fixe en celui d'acide carbonique; mais il ne nous a pas été possible de suivre le même plan à l'égard des acides dont la base nous était inconnue. Nous nous sommes trouvés alors forcés de prendre une marche inverse, et, au lieu de conclure le nom de l'acide de celui de la base, nous avons nommé, au contraire, la base d'après la dénomination de l'acide. C'est ce qui nous est arrivé pour l'acide qu'on retire du sel marin, ou sel de cuisine. . . . Nous avons nommé cette base inconnue *base muriatique*, *radical muriatique*, en empruntant ce nom, à l'exemple de M. Bergman et de M. de Morveau, du mot latin *muria*, donné anciennement au sel marin."

And in the index it is given: "*Acide muriatique*—son nom dérivé du mot latin *muria*, 61." As a matter of fact, the term was employed by Bergman and Scheele some years before the Lavoisieran nomenclature was published.

Loose, imperfect, or partial statements are, in fact, to be found on every other page. The word *eudiometer* is derived from *εὐδία*, calm air, and *μετρον*, a measure, "because it is used for the purpose of measuring gases (p. 51)." On p. 61, dissociation is defined to be "the gradual decomposition of a chemical compound by heat." Contrary to the statement on p. 44, hydrogen has *not* been liquefied. If this gas does not unite with oxygen at ordinary temperatures (p. 45), how is the action of platinum foil and of the Döbereiner lamp explained? The well-known process of extracting silver from argentiferous lead is called *Pattison's method* (p. 598). On p. 304 it is stated that phosphine unites with hydrochloric acid to form phosphonium chloride, and the statement is made that the reaction is perfectly analogous to that which takes place between hydrochloric acid and ammonia. It is nothing of the kind: phosphine and hydrochloric acid only combine under pressure, and the compound is dissociated, at ordinary temperatures, when the pressure is released. To judge from the statement on p. 281, the author is ignorant of the work of Tilden on the oxychlorides of nitrogen. The rusting of iron (p. 693) is *not* due to moisture in the air: iron does not rust in moist air in the absence of carbonic acid, as every tin-plate worker knows, and as Crace-Calvert, years ago, conclusively demonstrated. On p. 121 we have an account of chlorine trioxide, although Garzarolli-Thurnlackh, more than eight years since, working under Pebal's direction, showed that the substance so designated is a mixture of the dioxide with varying quantities of free chlorine and oxygen. The author still believes, apparently, in the existence of the ammonium-amalgam, and wholly ignores the work which shows that it is nothing but a metallic froth. He incorrectly describes the action of sulphuric acid upon potassium permanganate (p. 683), and tells us that no oxygen compound of fluorine is known, in spite of the existence of an oxyfluoride of phosphorus. The argument as to the valency of fluorine and the constitution of fluosilicic acid (p. 416), based on the supposition that hydrofluoric acid has the molecular formula H_2F_2 , falls to the ground in view of the recent work of Thorpe and Hambly. These by no means exhaust all the errors we had noted, but the list is sufficiently long to show that the book has apparently been hastily and somewhat carelessly put together. It has, however, certain good

points, and by a judicious overhauling might be made into a good book, for it is precisely one of those works that would have been better if the author had taken more pains.

THE MIDDLE LIAS OF NORTHAMPTONSHIRE.

The Middle Lias of Northamptonshire. By Beeby Thompson, F.G.S., F.C.S. Pp. 150. (London: Simpkin, Marshall, and Co., 1889.)

THE sub-title of this work explains that the subject is considered stratigraphically, palæontologically, economically, as a source of water supply, and as a mitigator of floods.

The author commences with some account of the beds grouped as Middle Lias, there being considerable difference in the classifications adopted by geologists, from the fact that the distinction between Middle and Lower Lias is mainly dependent on fossils. In considering this matter we have to deal with a series of clays, exhibiting a succession of organic remains, intimately connected, and yet characterized at different horizons by certain species of Ammonites. There are no stratigraphical planes of demarcation for our guidance, and it is merely a matter of convenience (or inconvenience as the case may be) to adopt a divisional line. The subject was discussed at some length in NATURE (vol. xv. p. 113) and we may therefore pass on to say that Mr. Thompson includes in his Middle Lias the zones of *Ammonites margaritatus* and *A. spinatus*, in this respect following the plan adopted by the Geological Survey.

As with the junction of the Middle and Lower Lias, so with that of the Middle and Upper Lias, there is, at any rate in Northamptonshire, evidence of intimate connection. We find, in fact, a "transition bed" between Middle and Upper Lias; and this, although but a few inches thick, has furnished a large number of fossils to Mr. T. Beesley, Mr. E. A. Walford, and the author of this work. Much interest attaches to this transition bed, from the fact that it contains an admixture of Middle and Upper Lias fossils, although a larger proportion of the former. Among the Upper Lias Ammonites found in it are *A. communis*, *A. annulatus*, and *A. Holandrei*; and it is noteworthy that *A. communis* and *A. crassus* are recorded also from the Marlstone below (zone of *A. spinatus*). All these species are very closely connected, and the abundance of *A. communis* in the lower beds of the Upper Lias of some parts of England, serves to show that its value as a zonal species in the uppermost beds is very local. We note that Mr. Thompson speaks of "falcifer" Ammonites—a mode of expression with which we fully sympathize, for the species, unfortunately, are becoming so much subdivided that before long no one but a specialist in Ammonites will dare to identify any particular form.

The work before us well illustrates the progress made in our knowledge of the details of British formations. The author has evidently laboured long and earnestly at his subject, and indeed no one but a resident geologist could have given us such particulars of the subdivisions of the Middle Lias and the fossils that occur in the

different layers, for some sections yielding valuable information are open but for a short time, and the geologist who spends but a few weeks in a district may fail to find exposures of every zone. Moreover, now increasing attention is given to the biological history of species, the precise position they occupy in the series of strata is of the greatest importance. Hence the work is of value not merely from a local point of view, but as contributing much material that will help towards a full knowledge of the Lias of Britain.

Summarizing his results, Mr. Thompson catalogues 94 genera and 273 species from the Middle Lias, including, however, but few of the Foraminifera. Vertebrate remains are scarce, but the conditions of deposit, as remarked by the author, were to a large extent shallow water and littoral marine—conditions that appear to be generally unfavourable to the preservation of the fishes and reptiles of the Lias.

The economic products of the Middle Lias are duly noted by the author. These are practically confined to building-stone and brick earth. The valuable iron ores found in some localities hardly come into the area, although some beds were at one time worked at King's Sutton.

Considerable attention has been given by the author to the question of water-supply, and in 1881 he suggested that the supply for the town of Northampton might be increased by the formation of a number of dumb-wells. In this way he anticipated that the surface drainage might be conducted underground through the Upper Lias, so that the porous beds of the Middle Lias would be utilized as a natural reservoir, while at the same time the liability to floods would be lessened. The scheme was brought before the Town Council, but, as the author candidly admits, the Water Committee, after consulting Sir Robert Rawlinson, were fully justified in rejecting it. It is, however, far from apparent that the scheme was faulty in theory. The natural storage of water has been advocated by several authorities, and it has been put into practice in India. The whole subject is worthy of close attention, and we can commend this portion of Mr. Thompson's book to those interested in the questions of water-supply and drainage.

H. B. W.

OUR BOOK SHELF.

A Dictionary of Explosives. By Major J. P. Cundill, R.A. Published by the Royal Engineers Institute. (Chatham: Mackay and Co., 1889.)

It is impossible to look at this list of explosive substances prepared by Major Cundill without coming to the conclusion that the chemist has had little to do with the most of them. Mixtures are things which do not delight the chemical mind either in an explosive substance or anything else. It places too much reliance on some mechanical operation, mixing or something of that kind, to give the chemical notion of exactness in its composition.

A theoretically perfect explosive would be a substance like hexanitro-benzene, $C_6(NO_2)_6$, but this has not yet been made. The variety and curious nature of substances and mixtures, many of them solemnly patented, described in this book, are most interesting. One, amongst several, is a mixture of carbonate of lime, chloride of sodium, and urine evaporated with charcoal. It seems pretty harmless as an explosive. Not so, however, many other mixtures